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PENMANSHIP.

MODE OF TEACHING PENMANSHIP ADOPTED IN THE NORMAL SCHOOL AT BARRE.

A VERY decided improvement in the mode of teaching the art of chirography, or handwriting, is practised at the Barre Normal School. It is as follows. A large blackboard is placed in front of the writing class. Four horizontal and parallel lines are drawn upon it. These lines are like the four lines found in ordinary, ruled writing-books ; and they are drawn at greater or less distances from each other, according to the size of the letters proposed to be made ; that is, the upper and lower lines are intended to give the letters a uniform length, and the two intermediate ones show where a succeeding letter should branch off from a preceding, &c., or where one part of a letter should be joined to another part of the same letter,—as where, for instance, in the letter *a*, the *i* should be united to the *o*. A letter is then selected for the lesson. Suppose it to be the letter *a*, in coarse hand ;—the teacher makes eight, ten, or a dozen, at his pleasure, with a chalk pencil, upon the blackboard. One of these letters he makes as perfect as possible ; but each of the others is made to deviate from the pattern letter ;—one to extend a little above the upper line, another to fall a little below the lower one ; one not to reach the upper line, another not to reach the lower ;—in one, the swell of the *o* part of the *a* should be too full at the top, in another at the bottom ; in one the curve or bend should be too acute, in another too broad ; in one, the inclination or slant should approach the horizontal too much, in another the perpendicular ; and so forth, and so forth, until the infinite forms of wrong are sufficiently exhausted. That the letters may be distinguished, let them be numbered, 1, 2, 3, 4, &c. We will suppose the model letter to be the fifth in the series. The class being all arranged in full view of the board, with their writing materials before them, the teacher proposes the following question. "Which of all the letters upon the board is the most perfect ?" and, waiting a moment, until every pupil, with eyes fixed upon them, has had time to form an opinion, he then names the scholar who is to answer the inquiry. The scholar will probably reply, *the fifth* ; if not, then the teacher inquires, whether any in the class are of a different opinion, and, if so, it is signified by the holding up of the hand, or by some other customary sign. After a unanimity of opinion is established as to the pattern, or model letter, the teacher begins with No. 1, and inquires of the whole class, in what its defect consists. After waiting a moment, as before, to allow every scholar to form his judgment, he calls upon one to answer the question. The scholar describes what he supposes to be the error in the formation of the letter. If the answer is incorrect, then the general question is put, whether all agree in the opinion expressed, and the matter is discussed and settled, as before. But if the answer should be correct, then the teacher proceeds, without delay, to No. 2. The same course is taken with regard to all the remaining imperfect letters. After the whole

series has been thus disposed of, the teacher, with more or less minuteness, as he may judge necessary, recapitulates what has been decided, in regard to each letter. "You all say, that No. 1 fails to be a perfect letter, on account of this excess; No. 2, on account of this defect; but that No. 5 comes near being a perfect letter. Now, fill a line of your writing-books with this letter, in which all the faults you have specified shall be avoided, and all those beauties you have named shall be copied." The pupils then write a line, and the teacher inspects their work. Wherever the teacher finds that a pupil has deviated from the model letter, or has made one resembling one of the imperfect letters, he calls his attention, specially and distinctly, to that point; he shows the pupil how he has violated his own rules, gone contrary to his own decision and judgment, copied a letter (pointing it out) which he had declared to be incorrect, and failed to imitate what he had pronounced a model.

Such lessons may be repeated, with any number of variations, until the pupils are exercised, not only on all the individual letters, but on the various combinations of them, into syllables and words;—exercised in regard to the letters, *d*, *h*, *g*, *f*, *p*, *q*, *y*, &c., and the manner in which one letter should be connected with another, the proper spaces between letters in the same word, between different words, &c. &c.

The waste in our schools, both of time and materials, in learning to write, is a subject of very general complaint; and even, after all the expenditure of time and stationary for acquiring the art of writing well, it is not acquired. Whoever occupies a situation where his duty requires him to read the petitions, remonstrances, &c., presented to our legislative bodies, or to examine heavy files of any kind of public manuscript documents, we venture to affirm, can never execute the task *without tears in his eyes*;—for, if sorrow does not excite them, straining will. So little success, indeed, do teachers ordinarily have, in perfecting their pupils in this important branch, that intelligent school committees have seriously proposed to abandon it altogether, during the ordinary school term, and, as a substitute for teaching it in the school, to expend a portion of the public money in hiring a professional writing-master, to make a circuit through the districts, and give instruction in this branch alone. Were the mode above described adopted and skilfully pursued, we believe it would supersede the necessity and save the expense of hiring an additional teacher, while it would increase many-fold the proficiency of the scholars in this useful branch of a Common-School education.

On the 191st page of this Volume of the Journal may be found an extract from the Report of the school committee of Danvers, describing an excellent plan for testing the proficiency of each pupil in writing, from year to year. As the winter schools are about to open, we again commend a consideration of this plan to all teachers and school committees.

While on this subject, we avail ourselves of the opportunity it presents, to notice a brief communication from 'An Engraver,' received some time since. Our correspondent complains, and very justly, that not only writers, but many teachers of writing, leave the letter 'J' out of the alphabet. He says, that when they want a 'J' on a ring, door-plate, visiting-card, &c. &c., they send an 'I' as a copy; and when the work is done, they inform him, that the initial is 'J' and not 'I,' and the work has to be done again. He says, very truly, that they have as good a right to substitute a 'Q' for an 'O,' as an 'I' for a 'J,' or to make any other alteration in the alphabet. We will give our correspondent, 'An Engraver,' one piece of legal advice, gratis, and that is, always to charge full price for making the 'I,' when it so stands in the copy, and, whatever may be the owner's initial, we will insure him a recovery for his services in any court of law. It is our fortune often to receive letters, in regard to which, it is impossible to tell whether the initial in the signature is 'I' or 'J;' and in some instances the 'I' is written like a 'J,' by being extended below the bottom of the line.

We seize upon this occasion, also, to enter our protest against all colors of ink, for common use, except genuine black. We will not discuss the question here, whether black is *a* color, but we maintain that is *the* color for writing. Black and white are, to a proverb, natural opposites. The contrast is necessary to the reader. A tinge of blue, in the paper, is a relief to the eye, but the ink should be pure, unadulterated, unsophisticated black. If one has only an occasional letter to read, or account to examine, it can be done without injury to the eye, though written in blue, red, or yellow. But a clerk, or an accountant, who spends his life over books and papers, or one who has thousands of manuscript pages to read at a job, needs all the appliances for relief that art can give, and then he is in danger of losing his eyes, and of having "pleasure at one entrance quite shut out." To use other colors is not advancement, but retrogradation; and alas! how often have we *wept over* this degeneracy of the times!

We subjoin a communication on the general subject of this article, which attributes much of the ill-success attending our efforts to teach children the art of writing, to the bad construction of seats and desks. When any man sits down to write at a table, he invariably draws his chair at least up to the table, if not partly under it. But in many of our schoolhouses, there are fixed seats and desks, with a space of from four to eight inches between the seat and the desk, so that the pupil must sit uncomfortably on the edge of his seat, and then bend his body forward, and almost stretch the vertebræ of his back, in order to reach the desk on which he is to write. Under such circumstances, it is next to impossible to learn to write well; and the handwriting of scholars in different schools will be found materially to vary, according to the construction of the desks and seats where it is practised.

[For the Common School Journal.]

PENMANSHIP.

Mr. Editor,—I noticed in a late Journal, a communication relating to penmanship. I was glad to find something of this kind,—to read the experience of one who has had an acquaintance with this important part of school education. I think, sir, that I can agree with your correspondent in his course of proceeding, provided other circumstances are favorable. But it seems almost an impossibility to make *good* writers with any method whatever, so long as we are destitute of any good place for writing. Most of our schoolhouses, however convenient in other respects, are not well adapted for writing. In order to learn to write easily and handsomely, it is of the greatest importance that the benches or desks, on which the scholars are to write, be properly constructed.

The desks on which the books are laid in most houses are much too narrow, rendering it wholly impossible for the pupil to receive that support for his arm, which is absolutely necessary, to write easily. There should be sufficient width for the arm to rest upon the flesh part, just below the elbow, and thus give steadiness to the hand; but in most cases, the scholar has to rest his wrist across the edge of his desk, thus *cramping* all the motions of his hand and fingers, after writing a very few moments. Now it appears to be the height of absurdity, to suppose we can make good writers where we have such benches. I care not how good his copy may be, it will be to little purpose that a scholar spends time in learning or trying to learn to write. With benches as poor and miserable as our houses generally have, it is almost an impossibility to find one scholar in ten, who will or can hold the pen in a proper position. If we expect to have good penmen, we must first make good benches to write upon. Out of a large number of schoolhouses, and several academies, with which I am acquainted, not *one* of them all is properly constructed for this important branch of education. It is to be hoped, that, in future, more attention will be paid, not only to writing, but also to preparing houses in a proper manner for writing. T. B.

MEMOIR OF DR. NATHANIEL BOWDITCH.

[Continued from the last Number, page 337.]

CHAPTER VIII.

From 1803 to 1817,—aged 30—44.

Mr. B. translates a Spanish paper: is chosen President of a Fire and Marine Insurance office.—Habits of life.—Becomes interested in politics.—Federalists and Democrats.—Great excitement.—Division between him and old friends, in consequence of zeal.—Feeling of Mr. B., when war was declared.—Decision of character.—His charity.—Earnestness in aiding others: ludicrous instance of the effects of this.—Boldness towards a truckman.—Zeal for improving the libraries: unites the two.—Dr. Prince's church.—Performance of duties of President of Insurance Office.—Answer to an overbearing rich man.—Appointed Professor of Mathematics at Harvard College: same at West Point.—His modesty.—Hints about leaving Salem.

Mr. Bowditch, on his arrival from sea, met with one of those events to which he always referred, when any one doubted the expediency of any kind of knowledge. In his voyages to Portugal and Spain, he had become acquainted with the Spanish language. It so happened, that no one else in the town was acquainted with it; and a paper, of much importance to a sturdy and sensible old sea-captain, came to Salem, but it was unfortunately unintelligible to him, for it was written in this same unknown tongue. A friend suggested to him that probably Mr. Bowditch would decipher it for him. The document was handed to Mr. Bowditch, who in a few days returned it, with a free English translation accompanying it. The old sailor was delighted, and immediately supposed that any one who knew so much about a foreign language must be a very superior person, and capable of performing any duties. Moreover, he was delighted with the apparent generosity of Mr. Bowditch, in making the translation without charge to his employer. It happened at this time, that an Insurance Office in Salem was in need of a President. The old Captain was one of the directors of this Institution, and immediately used all his influence in promoting the election of his young friend. This influence succeeded, and, in 1804, we find Mr. Bowditch installed as President of the Essex Fire and Marine Insurance Company. In this office he continued, with entire success, until 1823, when he removed to Boston, and took charge of other similar but much larger institutions. The relief was great, which he experienced from not being obliged to seek subsistence for his family by engaging in the sailor's life. The duties of the office in which he now engaged *seemed* to occupy all his time, yet he still did not neglect science. He arose at six in the morning, during the year; and took a walk, either before or after breakfast, of at least two miles. At nine o'clock he went to the office, and there he continued until one. After another walk, he dined, and, after a short sleep, he again visited his office until tea-time. From tea-time until nine in the evening, he was at his duties, and amid business. Now, it is very certain that he was not all the time, during office hours, actually engaged in business, but he was constantly liable to interruption, as much as he had been when an apprentice. Yet he found leisure enough for study, by early rising and regular habits. He used to say, "Before nine o'clock in the morning, I learned all my mathematics." He kept some of his books on philosophy at his office, and, whenever a moment of leisure recurred, he was busily occupied in science. At home, he had no private room for many years; and, as his family of young children grew up around him, he studied at his simple pine desk, in the midst of their noise and play. He was never disturbed, except when they failed in kindness to one another, and then he could never continue to study until quiet was restored. In truth, the influence of his studies was felt by his children, whose greatest reward was to

receive from him, in token of his approbation, the drawings of various constellations upon their arms or forehead. It was a sad day for them, when they did not receive from his pen the representation of the Belt of Orion, or of some other beautiful appearance in the heavens.

But, in addition to the duties of his office, he had begun to be interested in the political affairs of the day. After the Revolution, and the new government of the Country went into operation under the Presidency of General Washington, there had been but little political excitement in Essex county. There were no great parties, which were destined soon afterwards to spring up, and excite the bitterest animosity between individuals who had been from birth the warmest friends. It would be impossible, were it useful, to tell all the causes that led to the formation of the two great sects in politics, called the Federalists and Republicans. Suffice it to say, that even during Washington's connection with the government, the seeds of this division were beginning to spring up; and, upon the accession of Mr. Adams, father of John Quincy Adams who is now living, the rancor increased with tenfold energy, until at length the Republican party triumphed in the election of Thomas Jefferson to the office of President of the United States. In Salem, the violence of party spirit rose as high as in any city of the Union. It would have been surprising, with his desire for aiding any public cause, if Mr. Bowditch had not been influenced by the excitements of the day. He was much interested in them; and, in the note-books upon science, we find frequently brief memoranda of the results of an election at the bottom of a page, or at the end of some theorem. He was moreover, for two years, a member of the State Council.

We have scarcely any idea of the rancor with which the two parties contended. Persons who had been, during life, sincere and devoted friends, were separated by this virulence. Mr. Bowditch suffered as much as others, on this account, and two of his longest and best-tried friends he did not have any intercourse with, for many years. Dr. Bentley and Captain Prince were these persons, and with both of them you are already acquainted. It was not until 1817, when President Monroe visited these northern States, that harmony was restored between the two great parties, and friends once more embraced each other. But, in the midst of all this excitement with politics, Mr. Bowditch never neglected the duties of his office, or the study of science. In fact, the pursuit of learning had, as before, a sweet influence over his character. It made him calm and serene. An illustration of this you may find in what follows. In 1812, after a long series of supposed insults and wrongs from Great Britain, the American government declared war against that power. Mr. Bowditch was completely overcome by the news, and for two days was so much distressed, that he was unable to study. Friends who knew him never saw him look so saddened before, on any public emergency. He could speak of nothing but the disasters that he foresaw war would entail upon his country. On the morning of the third day, he arose, and, descending into the parlor, said to his wife, "It won't do for me to continue thus. I *will not* think any more about it." Saying this, he retired again to labor on science. The difference in his whole manner was very perceptible. He rarely afterward allowed himself to be disturbed by the unfortunate state of affairs; and, amid the placid thoughts excited in him by science, he found certain rest. Such should always be the benign influence of study.

Amid all these various engagements, he was full of sympathy for others. Wherever he saw he could aid with his counsel, he did so; and many widows and orphans have felt the influence of his charity. This charity showed itself chiefly in a desire to improve others. There was scarcely one of those connected with him, in friendship, upon whom he did not devote some time for their instruction. To one young lady he taught French, and another studied Italian with him. If a young man needed funds, he knew upon whom he could call with a certainty of substantial aid; for throughout life, it was

one of the remarkable attributes of Mr. Bowditch's character, that he could persuade many to open their hearts to the poor, who, upon other occasions, were deaf to the common feelings of humanity. For one young person of this kind, Mr. B. obtained a subscription sufficient to enable him to continue at the university, whereas his young friend would have been unable to do so, without assistance. He was always so zealous in these undertakings, that no one felt under any obligations to him. It was his delight to help, and every one saw that his heart was engaged in the cause. His zeal for humanity was at times immoderate, and a laughable instance of it occurred in 1801. Returning from his office, one day, he was informed that a little girl who lived with him had been run over by some careless persons, and a crowd, which he could perceive at a little distance from him, was a collection of individuals drawn together on her account. He immediately ran forward, and, getting to the outside of the circle, began very energetically to make his way into it. In doing so, he pulled one of the bystanders so forcibly, that the individual, as it will appear in the sequel, was offended. Arriving, however, by dint of hard pushing, at the object of his search, he took his little domestic with him, and guided her safely home. On the next day, he was much surprised at receiving a summons from a justice of the peace, to appear before him, to answer to the charge of assault and battery upon the individual above mentioned. He answered the call, and paid his fine of a few dollars; but the judge, who had been notorious for always making both parties suffer, when it was possible for himself to gain thereby, said, on receiving the fine, "But you say that Mr. —— pulled you, after you had pushed him." "I did, sir." "Very well, sir, then if you wish to complain of him, I will fine him, likewise." The ludicrous nature of the whole action struck Mr. Bowditch so forcibly, that he was not unwilling to increase the folly of it. The plaintiff was then fined, and the affair was ended. It is but right to say, that the judge was considered, previous to this, one entirely unfit for the office. Probably no other would have issued a summons on such an occasion; and the plaintiff was not unjustly punished for having called upon such a person to aid him in prosecuting an individual who, in exerting himself to help another, had slightly disarranged the dress of a bystander.

Mr. Bowditch's desire to aid the unfortunate was exhibited on another occasion, when a poor overladen horse was the object of his commiseration. A truckman had been violently beating the animal, in order to induce him to pull along a very heavy load, which was too large for his strength. Mr. B. had watched the driver for some time, and at length he ran vehemently forward, and in abrupt and decided tones ordered him to desist. The truckman was much superior to Mr. Bowditch in personal strength, and was, at first, disposed to ridicule the attempt of his inferior to restrain him. Full of indignation, Mr. B. exclaimed, "If you dare touch that horse again, and if you do not immediately seek another to assist him, I will appeal to the law, and you will see which of us two will conquer." The man yielded, and Mr. B. passed away.

The public institutions of the town all felt his influence. The East-India Marine Society, of which I have already spoken, improved very much under his auspices, as President. It had fallen considerably, during high political times, and, when he was chosen chief officer, he instilled such zeal among the younger members of it, and drew so many new members to it, that it revived; and, soon after his removal to Boston, the splendid hall was erected, containing the most remarkable collection of East-India curiosities to be found in the country.

The libraries of the town he had always felt very much interested in. You already know what reason he had for being devoted to the Philosophical Library, for from it he drew most of his knowledge of science. But there was another, which had been in existence much longer than this, called the Social Library. The books contained in these two collections were al-

most wholly distinct in their characters. In one, only works of science were to be found; while the other was chiefly devoted to literature. Mr. Bowditch saw that both of them united would be of great service to the community; for it would not merely combine the books, but the energies of the proprietors. Consequently, it appears that he, with another of the Philosophical Library proprietors, was chosen a committee, for the purpose of providing for a union. This was happily effected, in 1810; and the Salem Athenæum arose from the combination. The rooms over his office were chosen as the place for their deposit; and, for many years, he was one of the most active of the Trustees.

There was another institution, with which he was intimately connected during the whole of the time he lived in Salem,—I allude to the church in which his early friend, Rev. Dr. Prince, officiated. He was one of the committee of the parish; and, though never a member of the church, strictly so called, he was a constant attendant upon the services, and had great influence in keeping up the harmony and supporting the true dignity of the congregation.

In the performance of his duties as President of the Insurance Company, he was ever faithful and true. His desire was, to know the truth and to act up to it. He was frequently placed in circumstances which required great decision. At times, a disposition was shown to deceive him; at others, a similar one was shown by a richer stockholder to gain advantages over a poorer one. I well remember an anecdote in which it is said a purse-proud rich man strove to browbeat him into doing an act which Mr. B. thought would be unjust to another poorer one. The nabob pleaded his riches, and amount of stock, and intimated that he would have his way. "No, sir, you won't. I stand here in this place to see justice done, and, as long as I am here, I will defend the weak." He met with few difficulties of this nature, for few dared approach him with the intention to be unjust or untrue. Nothing aroused him so much to an almost lion fierceness, as any appearance of wickedness in the transaction of public business. He had much wisdom likewise in the selection of risks, so that the office, while under his control, succeeded admirably, and he left it prosperous.

During his residence in Salem, he was frequently invited to seats of honor and trust. We have already mentioned his political course. In 1806, by the agency of Chief Justice Parsons, then in the Corporation of Harvard College, he was appointed Professor of Mathematics in that University. In 1818, he was requested by President Jefferson, in very flattering terms, to accept of a similar office in the University of Virginia. In 1820, he was called upon by the Secretary of War of the United States to consent to an appointment at the Public Military School at West Point. All of these he refused, as not congenial to his mind. He always declined talking in public. He would teach all who came to him, but he could not deliver a public course of lectures. His extreme modesty prevented. For it will be remembered, that he was as remarkable, from his youth, for his modesty, amounting, in early life, to diffidence, as he was for his other qualities.

In 1813, he was urged to take charge of an Insurance Office in Boston, but he preferred living in his native place.

CHAPTER IX.

From 1803 to 1827,—aged 30—54.

Papers published by Mr. B. in the Memoirs of the Academy: account of some of them. —Total eclipse of the sun in 1806: *effect of it.—Anecdote of Chief Justice Parsons. —Meteor that fell over Weston, Ct.: account of its curious appearance: effect of these papers upon his fame in Europe.—Chosen member of most of the learned societies of the Old World.—Quits Salem, to become connected with larger institutions in Boston.*

It should be remembered, that, during these stormy political times, Mr.

Bowditch was chiefly engaged in making his notes on the great work to which we have already alluded, La Place's 'Mecanique Celeste;' and that it was between the years 1800 and 1820, that is, during this same time, that he wrote twenty-three papers, which were published in the Memoirs of the American Academy of Arts and Sciences. Of some of these last I will give you an account. Of the others, were I to mention them, you would understand but little. They relate chiefly to observations made upon the moon; the comets of 1807 and 1811; the eclipses of the sun which took place in 1806 and 1811; measurements of the height of the White Mountains in New Hampshire; observations on the compass; on a pendulum supported by two points; and the correction of some mistakes in one of the books studied first by him in early life,—I refer to Newton's 'Principia.' There are some of these papers which I may, in some measure, explain to you. I commence with his observation upon a total eclipse of the sun which occurred June 16, 1806. I shall quote nearly the words of the observer. "On the day of the eclipse, the weather was remarkably fine, scarcely a cloud being visible in any part of the heavens. I made preparations for the observations in the garden adjoining the house in which I reside, near the northern part of Summer street, in Salem. Having been disappointed in procuring a telescope of a large magnifying power, I was obliged to make use of that attached to my theodolite, which gave very distinct vision, though its magnifying power was small. An assistant was seated near me, who counted the seconds from a chronometer, and thus enabled me to mark down with a pencil the time when the first impression was made on the sun, without taking my eye from the telescope, till four or five [minutes] had elapsed, and the eclipse had sensibly increased; after which I examined the second and minute hands of the chronometer, and took every precaution to prevent mistakes. Four or five minutes before the commencement of the eclipse, I began to observe that part of the sun where the first contact [of the moon's shadow] was expected to take place; and eight minutes twenty-eight seconds after ten o'clock, I observed the first impression. As the eclipse advanced, there did not appear to be so great a diminution of the light as was generally expected; and it was not till the sun was nearly covered, that the darkness was very sensible. The last ray of light disappeared instantaneously. The moon was then seen surrounded by a luminous appearance of considerable extent, such as has been generally taken notice of in total eclipses of the sun." A number of stars became visible. The observer mentions that the light in the garden was not entirely gone; but in the house candles were needed, as if it were evening. At thirty-two minutes eighteen seconds after eleven o'clock,—that is, at a little more than an hour from the beginning of the eclipse,—the first returning ray of light burst forth, with great splendor. I have heard the effect, as described by those who saw it, as surpassingly grand. For suddenly, the light of midday seemed to break in upon the quiet of evening. So completely were all the animal creation deceived, that the cows returned lowing homeward, and the fowls sought their roosts, and quietly placed their heads under their wings. All human beings were looking in mute amazement, and deep silence prevailed, as the dark shadow of the moon came stealing over the surface of the sun, at noon. There was something fearful about the total obscuration of the luminary. Suddenly, this beautiful ray of burning light shot forth, 'mid heaven, and fell upon the earth, and with it arose a loud shout from the assembled crowd, and aged men* and women joined in the chorus, and saluted again the orb of day.

This paper, though short, is one of the most important he ever wrote. In

* Chief Justice Parsons, it is said, used to mention that moment as one of the most exciting of his life; and he could not forbear throwing up his hat, and joining in the shout with which his young companions saluted the first return of the sun.

a note to it, he first mentions publicly a mistake he had discovered in the 'Mecanique Celeste.'

In 1815, Mr. Bowditch published another paper, which I may be able to explain to you in some degree. We have all heard of falling stars, or meteors, and probably most of us have seen them frequently, when walking at night, when the sky is clear. Some of these are very small; they seem at a great distance. They suddenly appear in our heavens, and as suddenly disappear, and nothing more is heard or seen of them. Others, on the contrary, appear larger, and fall to the earth, after having traversed a great portion of the heavens. On the fourteenth of December, 1807, one of the most curious exploded, and fell over Weston, in Connecticut. But let me quote the paper.

"The extraordinary meteor which appeared at Weston, in Connecticut, on the fourteenth of December, 1807, and exploded with several discharges of stones, having excited great attention throughout the United States, and being one of those phenomena of which few exact observations are to be found in the history of physical science, I have thought that a collection of the best observations of its appearance at different places, with the necessary deductions for determining, as accurately as possible, the height, direction, velocity, and magnitude, of the body, would not be unacceptable to the Academy, since facts of this kind, besides being objects of great curiosity, may be useful in the investigation of the origin and nature of these meteors; and as the methods of making these calculations are not fully explained in any treatise of trigonometry common in this country, I have given the solutions of two of the most necessary problems, with examples calculated at full length. The second problem is not (to my knowledge) given in any treatise of spherics. The observations of the meteor which, after many inquiries, were found to have been made with sufficient accuracy to be introduced in the present investigation, were those made at Wenham, about seven miles northeasterly of Salem, by Mrs. Gardner, a very intelligent lady, who had an opportunity of observing it with great attention; those at Weston, by Judge Wheeler and Mr. Staples; and those at Rutland, in Vermont, by William Page, Esq." After giving the requisite solutions, he proceeds: "Some time after the appearance of the meteor, I went with Mr. Pickering to Mrs. Gardner's house, at Wenham, where she had observed the phenomenon. She informed us, that on the morning of the fourteenth of December, 1807, when she rose, she went towards the window of her chamber, which looks to the westward, for the purpose of observing the weather, according to her invariable practice, for many years past. The sky was clear, except a few thin clouds in the west. It was past daybreak, and, by estimation, about half an hour before sunrise, or seven o'clock. The meteor was immediately observed, just over the southern part of the barn in her farm-yard, nearly in front of the window; its disc was well defined; and it resembled the moon so much, that, unprepared as Mrs. G.'s mind was for a phenomenon of that nature, she was not at first aware that it was not the moon, till she perceived it in motion, when her first reflection (to use her own words) was,—where is the moon going to? The reflection, however, was hardly made, when she corrected herself; and with her eye followed the body with the closest attention throughout its whole course. It moved in a direction nearly parallel to the horizon, and disappeared behind a cloud northward of the house of Samuel Blanchard, Esq. She supposed the meteor to have been visible about half a minute.

"The attention of Judge Wheeler was first drawn by a sudden flash of light, which illuminated every object. Looking up, he discovered in the north a globe of fire just then passing behind the cloud which obscured, though it did not entirely hide, the meteor. In this situation, its appearance was distinct and well defined, like that of the sun seen through a mist. It rose from the north, and proceeded in a direction nearly perpendicular to

the horizon, but inclining, by a very small angle, to the west, and deviating a little from the plane of a great circle, but in pretty large curves, sometimes on one side of the plane, and sometimes on the other, but never making an angle with it of more than four or five degrees. Its apparent diameter was about one half or two thirds the apparent diameter of the full moon. Its progress was not so rapid as that of common meteors and shooting stars. When it passed behind the thinner clouds, it appeared brighter than before; and when it passed the spots of clear sky, it flashed with a vivid light, yet not so intense as the lightning of a thunderstorm. Where it was not too much obscured by thick clouds, a waving conical train of paler light was seen to attend it, in length about ten or twelve diameters of the body. In the clear sky, a brisk scintillation was observed about the body of the meteor, like that of a burning firebrand carried against the wind. It disappeared about fifteen degrees short of the zenith, and about the same number of degrees west of the meridian. It did not vanish instantaneously, but grew, pretty rapidly, fainter and fainter, as a red-hot cannon-ball would do, if cooling in the dark, only with much more rapidity. The whole period between its first appearance and total extinction was estimated at about thirty seconds. About thirty or forty seconds after this, three loud and distinct reports, like those of a four-pounder near at hand, were heard. Then followed a rapid succession of reports less loud, so as to produce a continued rumbling. This noise continued about as long as the body was in rising, and died away, apparently, in the direction from which the meteor came. Mr. Staples observed, that when the meteor disappeared, there were apparently three successive efforts or leaps of the fire-ball, which grew more dim at every throe, and disappeared with the last. From the various accounts which we have received of the appearance of the body, at different places, we are inclined to believe that the time between the disappearance and report, as estimated by Judge Wheeler, is too little, and that a minute is the least time that could have intervened.

"The observations made at Rutland were procured by the kind offices of Professor Hall, of Middlebury College, Vermont, to whom Mr. Page communicated his valuable observations in a paper expressed in the following terms. 'I was at the west door of my house on Monday morning, the fourteenth of December, 1807, about daylight, and perceiving the sky suddenly illuminated, I raised my eyes, and beheld a meteor of a circular form in the southwesterly part of the heavens, rapidly descending to the south, leaving behind it a vivid, sparkling train of light. The atmosphere near the south part of the horizon was very hazy; but the passage of the meteor behind the clouds was visible until it descended below the mountains, about twenty miles south of this place. There were white fleecy clouds scattered about the sky; but none so dense as to obscure the track of the meteor. I now lament that I did not make more particular observations at the time, and I should probably, until this day, have considered it to be what is commonly called a 'falling star,' had I not read in the New-York papers an account of the explosion of a meteor, and the falling of some meteoric stones, near New Haven, Connecticut, which, by recurring to circumstances then fresh in my recollection, I found to be on the same morning that I observed the meteor at Rutland. I am indebted to my learned friend, Dr. Samuel Williams, for his aid and directions in ascertaining the situation of the meteor, when I first observed it, and its course, and also for the order of my observations:—Form, circular; magnitude, less than a quarter of the diameter of the moon; color, red, vivid light; tail, or train of light, about eight times the length of its diameter, at the least, projected opposite to its course.'"

I quote these, to give you some notion of the appearance of this meteor, and likewise of Mr. B.'s diligence. From the examination of all the accounts given him, he came to the conclusion, that the body moved at the rate of

more than three miles per second, and at the height of eighteen miles above the surface of the earth. With regard to the magnitude of the body, the results were less accurate ; and the probability is, that all the body did not fall, but merely passed through the air, and continued on its course into unknown regions of space.

The other papers I shall not mention, because they are upon subjects difficult to be comprehended. The last appeared in the volumes of the Memoirs of the Academy, published in 1820. All these papers were read by the astronomers and mathematicians of Europe, and the consequence was, that he was chosen a member of many of the learned societies instituted there for the promotion of science. In 1818, he was chosen member of the Royal Societies of London and Edinburgh ; and, in the year following, was enrolled on the list of the Royal Irish Academy. While I am upon this subject, I would state, that he afterwards was elected member of the Astronomical Society of London, of the Academies of Berlin and Palermo, and had a correspondence with most of the astronomers of Europe. The National Institute of France was about choosing him one of its foreign members, only eight of which are chosen from the whole world, when he died.

In addition to the papers to the Academy, Mr. Bowditch published several articles in reviews, &c. One of them is an interesting history of modern astronomy, which is intended to give us an account of the lives and doings of the most celebrated astronomers of modern times. Such were the principal literary labors of Mr. Bowditch, during his residence in Salem.

But he was destined soon to leave Salem. In 1823, overtures were made to him to control two institutions in Boston, one for Life Insurance, the other for Marine risks. The offers were too liberal for him to refuse. His duties to his family led him to consent to do what nothing else would. On his determination being known, his fellow-citizens collected together, and paid him a beautiful tribute of respect and love, by inviting him to a public and farewell dinner.

As the family left Salem, Mr. Bowditch and his wife often thought that, after remaining eight or ten years at Boston, they would return, in order that their bodies might be laid by the side of those of their ancestors. But new friends awaited them in Boston ; new ties were formed there ; and, although they always looked to their native place as the seat of many of their sweetest and beloved associations, they both lived in Boston until their deaths.

His engagements of a public nature, during his residence in Boston, were similar to those he had whilst at Salem. For many years he managed both institutions. But, the directors, finding that the duties of one were sufficient to occupy all his attention, broke up the Marine Insurance Company, and Mr. Bowditch (or Dr. Bowditch, as he was now generally called, having received the degree of Doctor of Laws from Harvard University in 1816) devoted himself to the Life Insurance Office. This he raised to be one of the greatest institutions in New England. By an alteration in the charter proposed by Mr. B., this is now a great Savings Bank, where immense sums are yearly put in trust, for widows and orphans. The only difference in the habits of Mr. Bowditch, caused by his removal to Boston, was an enlargement of his labor. All objects of public utility still engaged his attention.

The origin of the modern lectures, of which we have now so many, commenced with the Mechanic Institution, of which he was the first President. He was zealous for the improvement of the Boston Athenæum, and was the means of getting for it large sums of money, and of making it more liberal to the public.

An honor was conferred upon him, after his arrival in Boston, which he thought the greatest he ever had attained. Having received two honorary degrees from Harvard University, and having been one of the Board of

Overseers of that Institution for many years, he was finally chosen a member of the corporation, or council of eight men, who guide the whole of the concerns of that important institution. How different the commencement and termination of the career of the poor son of a cooper, who, at ten years of age, left school, and yet, at the end of life, was one of the chief directors in the first literary institution in America! And his schoolmates, who laughed at him for his poverty, and thin, coarse dress,—where are they?

CHAPTER X.

Sketch of the Life of La Place, author of the 'Mecanique Celeste.'—Newton's labors.—Halley's comet.—The importance of astronomy to navigation.—Comets: Mr. Bowditch's labors upon this work: difficulties attending the undertaking: objects he had in view: first volume analysed: Newton's error pointed out.

In a former part of this story of his life, you will remember that I stated that, on his last voyage, Mr. Bowditch commenced his notes upon the 'Mecanique Celeste' of La Place. It was on the first day of November, during his disagreeable voyage homewards, in 1803, that he wrote his first note to the work which was destined to occupy much of his time from that moment until his death, thirty-five years afterwards, in Boston. This work certainly deserves some of our attention, if he thought it worthy of receiving the attention of so many years of his life. A brief account of the life of the author of the original work may interest you, and will serve as an introduction to the work itself.

Pierre Lucien La Place was born on the twenty-third of March, 1749, at Beaumont, on the borders of the beautiful and fertile country of ancient Normandy, situated in the northwestern part of France. He was the son of simple peasants in that country, and, from his earliest years, was remarkable for the extraordinary powers of memory and intense love of study with which he was endowed. At first, almost every branch of learning was delightful to him. He seemed eager to gain knowledge merely, without regard to the object of his study. But he soon began to distinguish himself upon the subject of theology, which, at the time of his youth, was beginning to be intensely interesting to all France. The pursuit of theology, however, was soon ended, and, by some means, of which no details now remain, his mind was led to mathematics; and from that moment, he was devoted to them. After spending his youth at his native place, and having taught mathematics there, he, at the age of eighteen years, went to Paris, to seek a wider sphere of knowledge. Bearing several letters of recommendation, as a youth of great promise, he presented himself at the abode of d'Alembert, who at that time was the first mathematician of France, and contended with Euler, at Berlin, for the honor of being the first in the world. But the letters upon which the youth depended so much proved of no avail. D'Alembert passed them by in silent neglect, without even deigning to receive at his own abode the bearer of them. But La Place was fully bent upon success, and, relying upon the force of his own genius as a more powerful recommendation than any letters, he sent to D'Alembert an essay, written by himself, upon a very abstruse subject, relating to mechanics. The Professor, struck with its elegance and deep learning, immediately called upon the writer, and addressed him in these words: "You see, sir, that I think recommendations are worth but very little, and for yourself they are wholly unnecessary. By your own writings you can make yourself better known than by any other means. They are sufficient. I will do all I can for you." In a few days after this conversation, the young man was appointed professor of mathematics in the public military school, at the capital of France. From this period, until the end of his life, he was occupied upon the science which he was called at this early age to teach publicly at Paris.

He became daily more acquainted with the great men of the nation, and was himself making additions to the scientific acquirements of the age, with a most extraordinary degree of perseverance. He was a member of the French Academy, or society of learned men united for the purpose of advancing the cause of learning, and he stood soon the first amongst them all. Later in life he published a work, called the 'System of the World.' In this, which is, comparatively speaking, not difficult to be read by almost any one, he attempts to give a plain and simple statement of all that is known in regard to those wise and magnificent laws whereby this solar system is kept together in perfect harmony, while at the same time it is sailing onward through fields of space. But his chief work, the 'Celestial Mechanics,' ('Mecanique Celeste,') he began to publish in 1799, and finished the fourth volume in 1805. This placed him far above all his contemporaries; for in it he had not only combined a vast deal of what he himself had discovered, but likewise gave a history, as it were, of all that had been done by geometricians from the time of Sir Isaac Newton until his own day. La Place found many things, detached, but his genius proved that many apparently discordant facts could be explained by Newton's theory of universal gravitation. His labor must have been immense. All Europe rung with the fame of this production, which was said to be beyond any thing ever performed before by man. The echo of its fame reached America, and Mr. Bowditch sought for the volumes, as they were successively published. The first two he received in part payment of his labor on the 'Navigator.'

La Place, however, was not a truly great man, because he was not just; he was willing to attribute to himself the discoveries of others. Moreover, there was none of the sweetness of humility about him. On Napoleon Bonaparte's becoming First Consul in France, La Place was made one of the ministers of the state; but he was found to be unfit for the office, and retired after a few weeks' service, but was made a member of the Senate, of which he became President. After finishing his political career, he published other works of great moment, but of which I shall not speak. About the year 1827, he was seized with an acute disorder, which soon terminated his life. His last words are remarkable, as conveying the same truth that every wise man has upon his lips at the hour of death. As he reviewed the amount of his learning, which was in one respect greater than that of any man living, he exclaimed, "What we know here is very little, but what we are ignorant of is immense." Every man is compelled to become silent and modest, as he sees death approach. La Place was like other common men. He died as a man, and was buried, and the men of science felt sad, that one so learned, and of so strong an intellect, should have departed; yet, alas, that we should say, few loved him. I have already stated that the reason was, his low ambition. Endowed by the Almighty with the loftiest powers of intellect, he stood alone, and commanded the respect of his associates; but, instead of using this intellect always nobly, he suffered his soul to be degraded by a love of paltry show, and with the gratification of a merely selfish vanity. Mr. Bowditch, though he regarded La Place as the greatest mathematician that had ever lived, had little real sympathy with his character.

We must now undertake to give you a short account of the 'Mecanique Celeste,' and of Mr. Bowditch's labors upon it. The original work consists of five volumes, but Mr. Bowditch lived to complete the translation of, and commentary upon, only the first four. There are about fifteen hundred pages in the original, while there are three thousand eight hundred and eighteen in the American translation. The object of the original work may be known from the following introductory remarks by the author, on the occasion of printing the first volume, in 1798: "Newton, towards the end of the last century, published his discovery of the laws of gravity, or of the power by which the solar system is held together. Since that period, geometri-

cians have succeeded in bringing under this law all the known phenomena of the system of the universe. I mean to bring together those scattered themes and facts upon this subject, so as to form one whole, which shall embrace all the known results of gravity upon the motions, forms, &c., of the fluid and solid bodies that compose our solar system, as well as of those other similar systems that are spread around in the immensity of space." You probably all understand from this quotation the general object of the 'Mecanique Celeste,' and you may understand, in some measure, the greatness of the task. La Place likewise informs us, that the work would be divided into two parts. In the first, he proposes to give the methods to be used in determining the motions of the heavenly bodies, their forms, the motions of the oceans and seas upon their surfaces, and finally, the movements of rotation of these spheres about their own centres. In the second part, he promises to apply the rules he has discovered in the first, to the planets and their satellites which move around them, and likewise to the comets. The first part is found in the first two volumes, the second part occupies the two last. From these few remarks, you will perceive the immense task imposed upon himself by La Place, and at the same time the grandeur of it. How wonderful, that a simple man dares attempt to mark out the course of the bright luminaries of heaven, which we see clustering around us at night! But how much more wonderful does man become, when we perceive that he has the power to foretell to us the return of comets, that have never been seen by any one living now,—comets, that have been, during our lives, travelling into the far-off fields of space! Strange, that a simple man can foretell, to a day, their return! Many of you doubtless remember a beautifully bright and clear comet, which a few years ago appeared, as had been predicted, after an absence of seventy-six years. It is called Halley's comet, after its first discoverer. At first, it seemed like a bright speck in the heavens towards the north; but the next night it was larger; it seemed to approach, with fearful rapidity, from evening to evening, and swept in majesty across our western sky, and gradually lost itself in its progress towards the sun, around which it whirled, and again appeared, more faintly visible than before, just over our eastern horizon, as if to give us one more glimpse of itself, a strange messenger of the Almighty, before it passed off on its far-distant journey, not to return, until we, who are now young and free as air, are all laid quietly in the grave, or have become enfeebled and decrepit by the approach of age. Truly, great is God; but to me, man seems full of grandeur, when I find him capable of even foretelling the exact passage of such a body. Yet La Place does thus; and in his 'Mecanique Celeste' may you find all the elements necessary for this object. But he likewise tells us the forms of the planets; he enables us to measure the ring which surrounds the planet Saturn, and even the form of the atmosphere surrounding the sun. In this same work he treats of those curious phenomena, which, as we see them daily, we think of little moment, the flow and ebb of the sea, or, in other words, high and low tides, and the causes of them. He treats of the motion of the earth about its centre, and the same motions in the moon and planets. These are the chief objects of the first and second volumes. The third volume, as we have already hinted, contains questions of great intricacy, and of immense importance; namely, the exact motions of the planets around the sun, as affected by all the attractions exerted upon them by the various bodies of the universe; and the still more important motions of our moon around the earth, I say important, because the exact knowledge of the course of this body is of the greatest moment to every seaman who attempts to go from one country to another, over the trackless ocean. By means of observations upon this planet, the sailor can sail over distant seas for many months, and be able to return, when he may wish, to his own home, in safety. Hence the importance of the astronomer to the simple navigator of our planet. The history of Mr. Bowditch is another proof of the truth of

this statement. By his accurate knowledge of astronomy, by his ability to follow La Place, in his investigations of all the motions of the solar system, he was enabled to produce a work on navigation which is sought for all over the world; as it combines the best methods of using the results of pure astronomy in the art of navigation. The 'Practical Navigator' would never have maintained its hold upon the community as it has done, if Mr. Bowditch had not been as skilful in mathematics and astronomy as in the details of navigation.

But to return to the 'Mecanique Celeste.' The fourth volume contains similar investigations, namely, the motions of the satellites, or moons, about the other planets. Of these, Jupiter's are the most interesting, after that of the earth, or our moon. There are four of them. These were the first that the invention of the telescope, by Galileo, revealed to man; and, by their frequent revolutions around the planet, they have in their turn shown to us many of the laws which govern the whole planetary system, besides many curious and important facts in regard to their own forms and masses. From the eclipses or disappearances of the first satellite, from its being on the side of the planet opposite to that at which the observer from the earth is looking, it has demonstrated the velocity of light. Finally, the author treats of the seven moons, or satellites, of Saturn, and likewise of Herschel, about which much less is known.

After treating of these subjects, La Place investigates the powers acting upon comets, which tend to turn from their courses those bodies, which, as I have before said, are flying in very many directions throughout the universe, and which are liable to be turned out of their direction by the action of some planets near which they may come. This was the case with a comet in 1770, whose course was wholly changed by the body of the planet Jupiter drawing it towards itself. To investigate the various laws of these disturbing forces is one object of this volume. Some other subjects are treated of; but of these I shall now not speak.

From this brief account of the 'Mecanique Celeste,' you may judge of the difficulties which the original writer had to overcome, in making it, and of the immense labor requisite. But La Place frequently supposes that a proposition is perfectly intelligible to his reader, because it is so to him. Having such a superior intellect, he was able to see that at a glance for which any one else would require a long demonstration, before he would become thoroughly master of the subject. The consequence of this is, an obscurity in the work, which has made it doubly difficult of comprehension. Several years ago, but a long time after Mr. Bowditch had read and made notes upon the whole work, an English writer said, that there were scarcely twelve men in Europe capable of comprehending it. Mr. Bowditch, feeling that it was the most important work upon astronomy ever published, had undertaken the translation of, and had made notes upon it, for the purpose of "amusing his leisure hours;" and upon its being known that he had finished the task, the American Academy proposed to publish it at its own expense; but Mr. Bowditch would not allow this, and reserved the publication until he was able to bring it forth with his own property. But let us see, now, what service Mr. B. intended to perform by his translation and commentary. His first object was to lay before America the greatest work of science ever published. Secondly, his aim was to bring that work down to the comprehension of young men and students of mathematics, by filling up those places left by La Place without demonstration. Thirdly, he meant to give the history of the science of astronomy over the world for the last thirty years. Fourthly, he added his own illustrations, and discoveries which he had made during the forty years of his life that he had devoted to science. His first aim was gained by the Translation. His second was completely successful, for he was assured by correspondents, both in America and Europe, that he had enabled several to read the immortal work of

La Place, who never would have done so, had not Mr. B. published his Commentary. The Royal Astronomer at Palermo says, in a printed work, published after the first two volumes of the Translation had reached him, "Bowditch's Commentary should be translated into Italian;" and Lacroix, a celebrated French mathematician, advised a young Swiss to read La Place in Mr. Bowditch's edition, rather than the original. But what pleased the commentator more than any thing else, were the frequent letters from young men residing in various parts of America, expressing gratitude for the benefits they had received from his work. When I think of these, I am reminded of the epithet bestowed upon Mr. Bowditch since his death, and by one well capable of judging, namely, 'Father of American Mathematics.' He has given a tone to the study of science which will be long felt.

In regard to the third object, all critics allow that he was eminently successful in giving the history of science up to the present time. Upon the fourth point, we might refer, first, to the immense increase of bulk of the work, as a proof, but I prefer to mention a few details; and, in order to this, let us examine the Commentary, and let it speak for itself. But it must be remembered, that, in making this examination, I must omit many circumstances, because you would not understand or feel interested in any greater detail.

In the first volume, he points out two errors of La Place, one of which relates to the motion of the earth; and the other is of much importance. It relates to the permanency of our solar system, as it is commonly called. You all doubtless know, that the sun is situated in the centre, and the planets, with our earth, revolve around this luminary, which gives light and heat to all. Now, these bodies revolve in certain fixed nearly circular directions, and La Place thought that they would always continue to do so, and that Mercury, Venus, the Earth, Mars, Jupiter, Saturn, and Herschel, would for ever continue to wheel around in their accustomed orbits. Mr. Bowditch proves, however, that, though this may be true of the three larger planets, Jupiter, Saturn, and Herschel, it is not equally certain, *from the proofs given by La Place*, that our earth, or any of the other smaller planets, may not fly off into regions far remote from those in which they have been revolving for ages. This error had been made the subject of a paper to the American Academy at an earlier period of his life. But it must not be supposed that there is any proof that the solar system will not continue to exist for many long ages. On the contrary, there is no doubt that it will last millions of years. Mr. Bowditch merely wished to assert that La Place's argument and calculation did not prove as much as the French mathematician thought they did. In this volume Mr. Bowditch likewise alludes to a topic which he had made the subject of a communication, a long time previously, to the American Academy; I refer to a mistake in Newton's 'Principia,' which he discovered when quite young, and had sent an account of to the President of Harvard College. This gentleman transferred the question to the Professor of Mathematics, who thought the youth was mistaken. Doubtless, he thought it very strange that a simple youth should presume to correct any thing published by so eminent a man as Newton. The error of the Professor will become less singular, when you learn that the same mistake escaped the notice of all the commentators on the 'Principia,'—that is, for more than a century; and that the cause of the original communication being made to the Academy was the attempt of Mr. Emerson, an Englishman, to prove the correctness of the English Philosopher. Every one, I believe, now allows that Mr. Bowditch was correct, and that a considerable error would result, in calculating the orbit of a comet, in using Newton's calculations.

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